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ABSTRACT

An innovative approach to enhance high school instruction in Alaska is summarized in this paper describing IST (Individualized Study by Technology), a program which permits small, isolated rural schools to provide a more complete high school curriculum, reduce teacher workloads, and allow students to work at their own pace. The program goal of developing whole courses to be taught in rural Alaskan high schools is discussed, as well as the media model used to design the programs. Illustrations are given for the individualized, multimedia, instructional model, which includes the teacher, traditional texts, and printed materials; computer-assisted/managed instruction; and audiotape cassettes. The teacher's role in IST teacher training is then explained. Evidence of IST's effectiveness as indicated by teacher and student attitudes and by student learning is analyzed, based on an evaluation of the 1980-81 pilot testing of the Alaska history, English, developmental reading, and general math courses. Cost analyses are also provided. The summary addresses problems faced by course developers and the three-part solution which evolved to meet these problems. Conclusions and implications are discussed, and six references are listed. (LMM)

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DEALIZED STUDY BY TECHNOLOGY (IST) FOR ALASKA. A MODEL OF THE FUTURE?

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Alaska is the largest state in area, more than twice the size of Texas, and is also the most sparsely populated of the 50 states, averaging less than one person per square mile. Thus, Alaska faces unique problems in providing high quality secondary education to its children in the many small, isolated rural communities located throughout the state. Prior to 1975 many rural Alaskan children had to attend boarding schools in the larger Alaskan cities or the lower forty-eight states in order to obtain a secondary school education. This situation was unsatisfactory to parents. Furthermore, many of these children were not able to complete their secondary education due to the homesickness and culture-shock they experienced when they left their homes and families.

In 1975 two events occurred that changed the course of Alaskan secondary education. First, the state-operated school system in Alaska was disbanded by state law, and replaced with 21 Regional Education Attendance Areas (REAAs). These REAAs received virtually 100 percent of their funding from state taxes, but each had its own locally elected board with full policy-making powers. The second event in 1975 was the settlement of a lawsuit (Hootch vs. Lind) that established the right of Alaskan children to an education through twelfth grade in their own community. As a result of these two events, rural Alaskan children would no longer have to leave their homes and families to receive a secondary school education.

Presently, about 180 small Alaskan communities have educational programs in grades nine through twelve. However, about 60

of these communities have secondary schools with 10 or fewer students, and another 95 or so have schools with fewer than 50 students. In such small schools it is not feasible to hire a large number of teachers with specialized knowledge to offer a comprehensive array of high school courses. Innovative uses of resources to satisfy curriculum needs are essential if these communities are to provide their children with a quality secondary level education. Several approaches now being used to enhance high school instruction in Alaska are student exchanges, itinerant teachers, mobile labs, televised (or videotaped) instruction, correspondence courses, and educational student trips. Individualized Study by Technology (IST) is one such innovative approach utilizing the microcomputer. Courses developed in the IST program permit the small, isolated, rural schools to provide a more complete high school curriculum, reduce the workloads of teachers, and allow students to work at their own pace.

THE GOAL OF IST AND THE MEDIA MODEL

The goal of the Individualized Study by Technology (IST) program is to develop whole courses to be taught in the ninth through twelfth grade curriculum in rural Alaskan schools. The Northwest Regional Educational Laboratory (NWREL) in Portland, Oregon is the design and implementation contractor for the program, funded by the National Institute of Education (NIE) and the Alaska Department of Education (DOE). Panels of Alaskan educators have advised the Northwest Regional Educational Laboratory (NWREL) in regard to the priorities for developing the courses

within the IST program - making selections from among exist
ing materials and recommending modes of instruction. In additi
on, review committees of Alaskan teachers have assisted with and m
onitored course development.

Six full-year and two half-year courses have thus far been de-
veloped within the IST program. Two courses, Alaska History and
English, were developed in 1979 and pilot tested in seven ru
ral Alaskan schools during the 1979-1980 school year. Two more co
urses, Developmental Reading and General Math, were then develo
ped in 1980. All four of these courses were pilot tested in 29 ru
ral schools during the 1980-1981 school year. Currently about 100
rural Alaskan schools are using at least one of the four pi
lot tested courses. In addition, two new courses developed in 19
81, General Science and United States History, have each been pi
lot tested in seven rural schools. Health Education and Business Ed-
ucation are the two half-year courses available for use in the
1982-1983 school year.

These IST courses have been designed to overcome several pr
oblems faced by Alaska in providing quality secondary educatio
to its children in the many rural communities located throughout the
state. A typical rural Alaskan secondary school is staffed by
three or fewer teachers providing instruction to a total of 50 or
fewer students. The combined expertise of these teachers is
rarely sufficient to provide the students with a comprehens
ive array of high quality secondary school level courses. The ru
ged terrain and severe weather conditions make travel and commun
ca-
tion difficult, if not impossible, during much of the sch
ool

year, isolating the communities from outside educational resources and facilities. Many students at the rural schools are of a native ethnic background. Many have poor reading and mathematics abilities (relative to the students in the larger Alaskan cities), and some attend school irregularly.

The IST program attempts to overcome these problems by utilizing an individualized multi-media instructional model which includes the teacher, traditional texts and printed materials, computer assisted/managed instruction using the Apple II microcomputer, and audio cassette tapes. The teacher manages the integrated use of the three media components which provide the primary instruction in each lesson of the IST courses. For example, in an Alaska History lesson introducing students to the geography of Alaska, the students:

(a) listen to a dramatic episode on an audio cassette tape which primarily introduces geographic terms;

(b) perform a computer activity composed of multiple choice questions which review the terminology previously introduced in the audio cassette tape;

(c) read a passage entitled "Geography of Alaska: Introduction" which presents general information about the geography of Alaska; and

(d) perform another computer activity composed of multiple choice and fill-in questions which review the general information previously presented in the reading passage.

Although used in an integrated fashion, each media component serves specific purposes (see Figure 1). The traditional texts and printed materials include published textbooks, texts adopted from correspondence courses, reading selections, worksheet exercises, and projects. The texts and readings are intended to be

the primary sources of information for the students; the worksheets and projects are intended for drill of concepts and their application.

The microcomputer instruction includes activities which introduce vocabulary, develop map and problem-solving skills, and drill essential facts, concepts, and concept applications. The microcomputer provides immediate feedback to the students, indicating the correctness of their responses and the correct answers if incorrect ones had been given. The microcomputer also serves several student management functions. These functions include keeping up-to-date records of students enrolled in an IST course, recording and storing activities completed and test scores on student computer disks which can be accessed by teachers for grading purposes, and modifying student disks to alter the sequencing of computer activities if desired.

The audio cassette tapes include lectures, dramatic episodes, teacher-student dialogues, narrations, and interviews. They are intended not only to introduce and reinforce skills and concepts and supplement information presented in the printed materials, but also to guide students through reading and written work, and to repeat in aural form information which students might have difficulty reading. Several tapes are accompanied by worksheets called listening guides. This format provides students the opportunity to confirm in writing their understanding of the concept being taught and to receive immediate feedback on, and explanation of, correct responses.

FIGURE 1

IST MEDIA MODEL

COMPONENT	FORMAT	PURPOSE
Printed Materials	Published textbooks Correspondence course texts Supplemental readings Worksheets Projects	Present information Drill concepts Concept application
Micro-Computers	Multiple choice & fill-in question activities Review activities Tests Student record reports	Introduce vocabulary Develop map reading skills Drill facts, concepts & applications Evaluation Student management
Audio Cassette Tapes	Lectures Dramatic episodes Narrations Interviews Listening guides	Introduce skills & concepts Reinforce skills & concepts Supplement printed materials Guide thru readings & written work Repeat in aural form information difficult to read

THE TEACHER'S ROLE IN IST

The teacher is an essential element of the IST program. The teacher's time is actively spent in managing and facilitating student learning through such activities as: a) providing one-

on-one and small group instruction, b) providing constuctive feedback to stude ts by correcting the IST written work, c) maintaining records f student performance, d) monitoring student progress, and e) managing the use of the microcomputer. These tasks are somewh t different from the more traditional teacher tasks of: a) pl nning the course structure, b) developing and organizing the co rse materials and activities, and c) presenting the subject matte to the students. The teachers, therefore, who supervise IST cou ses are able to give more personal attention to specific instruct onal needs of students and devote more time to other responsibil ties at their school.

The IST progra allows for flexibility in classroom management procedures. No single classroom organization model seems to be most effective.

IST students in smaller schools often work on various IST cours s in the same classroom as other students simultaneously work ng in non-IST courses. Such a classroom is often divided into reas serving distinct functions: one area is designed for grou instruction, another for individualized study, and a third for storage and for students working with the computer and listeni q to the audio tapes. The individualized reading and written w rk required of the IST students is completed in the area set asid for individualized study.

IST students i the larger schools are usually set apart from other students wo king in non-IST courses by either: a) designating a single c lassroom as the IST room; or b) conducting the IST courses in d ifferent classrooms during specified periods in the school day.

In the latter case, the IST equipment, particu-

larly the computer and its associated materials, is stored and used in a central learning resource center or library.

The best model for supervision of the IST courses is for the teacher to be in the same classroom as the students and to be available to provide IST students with assistance as needed. The IST students, however, do not require constant supervision. Most teachers are able to attend to other responsibilities, such as assisting non-IST students, correcting written work/tests, and record-keeping, while they are supervising the IST students.

Most teachers develop some procedures that govern student access to the microcomputer. Although these procedures often result in some students not having access to a computer at any given moment, rarely does anyone have to wait long. The flexibility in the structure of the IST courses usually permits students to work on other IST activities while they wait. The most efficient student-to-computer ratio is about six IST students per computer per class period. This ratio maximizes computer use while minimizing the waiting time experienced by students.

A comprehensive set of materials comes with each IST course. The complete IST Alaska History course, for example, has five large loose-leaf-like teacher guides for each of the five units of the course, five student manuals for each student, cassette tapes, selected reading materials, and computer diskettes. Accessibility is greatly enhanced by placing the materials presently being used by the students in an organized manner on easily accessible bookshelves and storing the rest of the materials in an out of the way, secure, dry, and cool place until needed.

Figure 2 summarizes the total role of the IST teacher. This role is less instructional in nature than that of the teacher in a traditional course, but may involve more organizational and management activities, particularly in the small rural schools. The total time required of the IST teacher, however, is about one-third less than that of the traditional teacher.

FIGURE 2

SUMMARY OF TEACHER'S TOTAL ROLE IN IST

INSTRUCTIONAL
Providing one-on-one and small group activities
Correcting written work and providing feedback
ORGANIZATIONAL
Arranging the classroom to foster learning when several activities are occurring simultaneously
Developing computer scheduling procedures
Storing materials in such a way as to make them easily accessible to students when needed
MANAGEMENT
Maintaining student performance records
Monitoring student progress
Managing the operation of the microcomputer

TEACHER TRAINING FOR IST

Training and assistance for IST supervising teachers is essential to the successful introduction and implementation of the IST

courses (see Figure 3). Teachers who participated in the 1980-1981 pilot testing of the Alaska History, English, Developmental Reading, and General Math IST courses attended a three-day pre-service training workshop prior to beginning the IST courses in their schools and a two-day mid-year meeting. In the workshop the teachers were introduced to the IST program, its courseware, media components, and procedures. Teachers were provided with a detailed course guide which included copies of all student activities and answers to all exercises. The roles and responsibilities of the teacher in the IST program were also covered. Each teacher had "hands-on" experience with the first few lessons in each course. The teachers practiced the setting-up, operation, and management of the microcomputer, as well as procedures for preventing and solving hardware problems.

The mid-year meeting brought the teachers together to share their IST experiences with other teachers and with the representatives of the Alaska Department of Education (DOE). Successful strategies and problem areas concerning implementation of the IST courses were identified and discussed, with solutions recommended. Additional "hands-on" IST training and demonstrations were provided.

In addition to the pre-service workshop and the mid-year meeting, each pilot test school was visited twice by IST support staff from DOE. The initial visit (of two to three days) occurred early in the school year and served the purpose of assisting with the implementation of IST in the classroom. The primary purposes of the second visit were to observe the operation of the

IST courses in the schools and to assist teachers with any problems they were having.

FIGURE 3

SUMMARY OF IST TEACHER TRAINING

Pre-Service Workshop:	Introduces teachers to the IST program, its courseware, media components, and procedures.
Mid-Year Meeting Site Visits by DOE Staff Telecommunications Network	: Provides teachers the opportunity to interact with each other and DOE representatives concerning IST experiences, problems, and solutions.
Teacher Course Guide:	Provides teachers with helpful hints from experienced IST teachers, concerning classroom management and organization, and provides answer keys for all student worksheet, test, and computer activities.

The teachers who received the training during the pilot testing reported that they considered the training to be worthwhile, but not overly demanding. About half of the teachers considered the amount of training to be reasonable but demanding; the remainder considered it to be easily accomplished.

Teacher training and assistance is now more efficient and cost-effective as a result of the experience gained by DOE during the 1980-1981 pilot testing. Regional pre-service training workshops are now conducted, reducing the cost of training both in terms of time and money. A telecommunications network has been set up through which teachers can contact other teachers or DOE representatives for assistance with IST problems, cutting down on the number of needed school visits. Additionally, improved teacher guides are now available which include helpful hints from experienced IST teachers.

EVIDENCE OF IST'S EFFECTIVENESS - TEACHER AND STUDENT ATTITUDES

Educational Skills Development, Inc. (ESD) of Lexington, Kentucky conducted the evaluation of the 1980-1981 pilot testing of the Alaska History, English, Developmental Reading, and General Math IST courses, under contract to the Alaska Department of Education. Twenty-nine schools, representing a wide range of rural Alaskan settings, implemented at least one of the four courses. Most schools were located in communities of less that 300 people, with primarily a native population, and where most adults had not completed high school. The median size of the schools was 50 students with 3 teachers. Each teacher was required to offer several courses, often in several different subject areas, in order to provide a ninth through twelfth grade curriculum. The schools resembled in many ways the one or two room schools operating 30 years ago in the rural sections of the lower 48 states.

Thirty-nine teachers supervised one or more of the IST courses during the 1980-1981 pilot testing. Nearly 75 percent of these teachers considered the IST courses to be well-designed for their classrooms. Also, about two-thirds viewed the amount of work required to manage and operate the IST courses as generally less than that required when using traditional courses. No teacher considered the courses to be "too much work" or "not worth the bother".

Most teachers reported a preference for using entire courses, rather than parts of them. All teachers who would prefer to use parts reported that they would like to use the computerized instruction and IST workbooks and exercises. The teachers generally felt that the microcomputer activities and textbooks were the components of the IST courses most compatible with their teaching styles. Audio cassette tapes and projects were considered the least compatible. The computer activities were viewed by the teachers as the most interesting component of the courses for the students; the supplemental activities were viewed as the least interesting. The supervising teachers were generally very satisfied with the design and usefulness of the IST courses.

Teacher attitudes reflect the fact that relatively few serious Apple computer problems were reported during the 1980-1981 pilot testing. A total of 12 hardware malfunctions were reported for all schools resulting in an average "down" time of 25 days. Microcomputer software and diskette problems seemed to occur at rates similar to the hardware problems. Considering the environmental conditions and prior experience of personnel at the

schools, the m
crocomputer equipment was extremely reliable. The breakdown of e
quipment, therefore, was a relatively minor concern in the impleme
ntation and effectiveness of the IST program.

Over 90 per
cent of the 304 students enrolled in one or more of the IST course
s considered the microcomputer exercises interesting; about 59
percent found the reading and written components of the IST course
s interesting; and 49 percent considered the audio cassette tapes
interesting. The audio cassette tapes were the only IST media
component considered boring by a significant percent of the s
tudents (27 percent). Most students reported the difficulty lev
el of the courses to be "about right" for them. Also, half o
f the students indicated they almost always understood what ne
eded to be done and could work by themselves on their courses.
No students indicated that they rarely or never knew what to
do and almost always had to get help from their teacher. Thes
e data suggest that: a) most students find learning using the IST
media components of instruction an interesting experience and
) the instructions and procedures in the IST courses are suffic
ient for most students to have confidence in their ability to pr
ogress through the courses on their own.

EVIDEN
E OF IST'S EFFECTIVENESS - STUDENT LEARNING

The studen
s' pre-course and post-course ability relative to the content o
f the courses was measured by paper-and-pencil tests. The s
udents' test scores in the Alaska History, English, and General M
th IST courses were based only on those items related to the
portions of the courses they completed. However,

items on the Developmental Reading test were not related to any particular portion of the course, thus students' reading test scores were based on all questions on this test. Prior to their enrollment in the IST courses, the students, on the average, were generally unfamiliar with the content of the Alaska History course, and somewhat familiar with the content of the English, Developmental Reading, and General Math courses. At the end of the school year, the mean test scores increased to between 60 percent and 70 percent in all four courses. These mean scores represented an average gain of 30 percent in Alaska History, of 12 percent in General Math, and of 10 percent in English and Developmental Reading.

The most significant factor in overall student performance in all four IST courses was the students' prior knowledge of the course content. After taking into consideration this pre-course knowledge, students' pre-course math and reading skills (as measured by the subtests of the Alaska Statewide Assessment Test) were also significantly related to student performance in all four courses. Student age and grade level did not significantly relate to student performance in any of the IST courses.

Student performance was significantly better in the IST courses supervised by teachers who felt their prior experience had prepared them: a) to manage students when several different activities are occurring simultaneously in the classroom and b) to use audio cassette tapes in the classroom.

COSTS OF THE IST COURSES

The total cost per-student in the 1980-1981 pilot testing averaged $1620 for each complete course. The per-student cost to the Alaska Department of Education made up the majority of the total costs, averaging $1470 per course. The average per-student cost to the schools was $150 per course. These costs included all print, audio cassette tapes, and microcomputer materials and equipment.

Most of the DOE per-student costs in the 1980-1981 pilot testing were for course development. These are one-time costs, thus as the number of students using the IST courses increases the per-student costs to DOE substantially decrease, while the per-student costs to the schools increase minimally. For example, based on six students per course at each of 100 schools, DOE per-student costs reduce to an average of $207 per course while the estimated average per-student costs for a school increase to only $209 per course. Given that the course development has already occurred, the costs to DOE for the IST courses will continually decrease in the future. The costs to schools, however, will probably rise somewhat due to inflationary increases in costs for equipment and printing. The teacher training costs to schools will likely decrease in the future, however, due to more efficient training procedures and a reduction in the number of teachers needing the training.

Using the 1980-1981 pilot test data, the costs to the schools of offering the IST courses can be compared with offering similar courses taught by teachers qualified to teach in the appropriate

secondary level content areas and using the IST print materials. Conservatively, the hiring of 20 additional teachers would have been necessary to offer similar courses to the 1980-1981 pilot test students, if the IST courses were not available. Taking into consideration the costs for these additional teachers, offering the complete IST courses was nearly one-half the cost of offering similar courses with just the print materials and the additional teachers. This estimate cannot be applied to any particular school since some schools would not require additional teachers, while others would need two or more. However, the overall reduction in costs from implementation of the IST courses would probably be significant at most schools.

SUMMARY

The problems faced by IST course developers in Alaska were many-fold. Courses were to be taught at small, rural schools, most so remote that they have to generate their own electricity. These schools often have to offer a complete high school curriculum with a teaching staff of two or three members. Students were below state norms in reading and mathematics achievement. Often they were members of native Eskimo and Indian cultures. Students could not attend school regularly due to economic and weather conditions. One asset though was a group of experienced teachers present in these remote schools who were accustomed to coping with the difficulties of living and teaching in rural Alaska.

A three part solution gradually evolved to meet these problems. First, a media model to use in developing self-instruc-

tional materials was formulated by the Northwest Regional Educational Laboratory to guide course material development. The resulting courses were then passed on to teachers by the Alaska Department of Education through training workshops and follow-up school visits. These activities focused both on use of materials and equipment and the definition of the teacher's role. Finally, teachers and administrators made classroom organizational decisions which allowed for the full use of the IST courses. The IST program, thus, consists of a self-instructional multi-media model for course development, a set of training activities for teachers, and classroom organization plans. All three are necessary for successful implementation of the IST courses. Each component is primarily the product of a different group, the Northwest Regional Educational Laboratory, the Alaska Department of Education, and the teachers and administrators in the rural schools.

This three part solution has resulted in the development and subsequent classroom use of courses in which students show significant learning gains while generally completing the courses in a reasonable amount of time. Teacher and student attitudes are positive, and costs associated with IST courses are reasonable. The computerized instruction in the courses was felt by instructors to be most compatible with their teaching styles and most interesting by students.

The IST program has shown that courses relying heavily on self-instruction can work with a wide range of students. Both student reports and the results of pre-course and post-course testings show that isolated rural students in this program can

progress through these courses on their own. Variables that influenced their progress - prior knowledge of the course content and general reading and mathematics skills - were identical to those that impact on typical students. For a course to be effective then, with rural Alaskan students, it must have a good instructional design.

The IST program also points out the need for cooperation and coordination among three groups of educators in order for classroom changes to take place. First, high quality course materials must be produced by an organization skilled in instructional product development. Second, the State Department of Education must sponsor the dissemination of those materials through teacher training activities. Finally, the classroom teachers must develop methods of using these materials in widely varying classroom situations. The absence of the efforts of any one of these three groups would result in the program having minimal or negative impact on actual classroom activities.

The success of the IST program gives encouragement and direction to future efforts in educational innovation. The multi-media instructional design, on which the IST courses are based, provides a working model of how various media options and computers can successfully be integrated to develop courses that can be effectively implemented into those classrooms fostering individualized instruction. The process of cooperation among the instructional designers, the Department of Education, and the classroom teachers in the development of the program serves as a model for the development of future educational changes. The IST

program thus yields both product and process models that should be widely used by education in meeting the challenges of the 1980s.

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